

# High-Frame-Rate Oil Film Interferometry

Jonathan C. White, Russell V. Westphal, John Chen

Mechanical Engineering Department,  
California Polytechnic State University, San Luis Obispo, CA 93407, USA

October 18, 2010

## Abstract

The fluid dynamics video to which this abstract relates contains visualization of the response of a laminar boundary layer to a sudden puff from a small hole. The boundary layer develops on a flat plate in a wind tunnel; the hole is located at a streamwise Reynolds number of 100,000. The visualization of the boundary layer response is accomplished using interferometry of a transparent, thin film of oil placed on the surface immediately downstream of the hole and with its leading edge perpendicular to the direction of flow. Through lubrication theory, it is understood that the rate of change of the spacing of the interference fringes is proportional to the skin friction at any instant. For reference, a small disk-shaped protrusion of the type often used to trip the boundary layer in wind model tunnel testing is also shown. Three cases with different puff strengths are included. Using a high-speed commercial camera, frame rates in excess of 1000/sec have been recorded; the video shown here was taken at 24 frames/sec to remain within prescribed file size limits.